COMMENTS

Health Risks of Low-Dose Ionizing Radiation in Humans

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I read with interest the review of Prasad *et al.* (1) on health risks of low-dose ionizing radiation. Moreover, in the paper, pregnancy exposure in regards of teratogenicity is less stressed, even if it represents a frequently asked counseling question in a teratology service.

The risks of fetal exposure to x-rays have been the subject of numerous studies over the past 50 years, even if the effects of low doses are still somewhat unclear. The lack of clear information has given rise to unjustified panic among pregnant women. Indeed, fear of x-ray–induced fetal defects has led some women with unsuspected pregnancy that underwent radiography to terminate the pregnancy. In addition, many doctors tend to refrain from performing necessary dental, chest, or other forms of radiographic imaging in pregnant women.

Counseling of pregnant exposed patients must be based on accurate and understandable information about the risks of radiation exposure *in utero*. Risk estimates should be considered absorbed dose, timing of the exposure relative to conception, and the form of administration. For this purpose, dose estimation for different x-rays examinations have been elaborated (2, 3).

The radiation dose of interest is the absorbed dose, the mean energy imparted per unit mass, to the conceptus and not to the mother. This is expressed as gray (Gy) or milligray (mGy). One gray is equal to 1000 mGy or 100 rads.

In the literature, there is no evidence in either humans or animals that radiation exposure in the diagnostic ranges (i.e., <50 mGy) is associated with an increased incidence of any significant congenital malformation. (4). In fact, in the preimplantation embryo, there is no measurable risk of malformation regardless of the amount of radiation exposure, and the greatest concern is death of the embryo. At this stage, if an embryo is exposed to 10,000 mrad, the risk of death is 2%. Between 3 and 10 weeks of pregnancy, the threshold for the detection of an increase in birth defects is 5,000–25,000 mrads, which is significantly greater than that delivered with diagnostic medical imaging. After 10 weeks, risk of congenital malformations decreases. At this stage of development, there is a risk of microcephaly, but the threshold of detection is at a radiation dose greater than 12,000 mrads. After 17 weeks, the greatest risk is of mental retardation or growth restriction but only at doses that are likely to cause symptoms of radiation poisoning in the mother. Based on the negligible risks outlined here, women can be reassured that the benefit far outweighs the risk with regard to diagnostic imaging with a predicted fetal absorbed dose of less than 1 mGy. This includes all x-ray and CT scanning not involving the abdomen. For direct exposures or nuclear scanning with a potential exposure greater than 1 mGy, a more detailed explanation should be given, emphasizing the minimal risk below 10 mGy, that is, with a specific informed consent (5).

In conclusion, diagnostic radiography exposure during pregnancy is frequent and gives anxious in pregnant women. Literature data have largely demonstrated that x-rays not involving direct abdominal/pelvic high dosage are not associated with any significant adverse events.

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Counseling of pregnant women who require diagnostic radiography as well as those inadvertently exposed should be based on the available human data with an emphasis on the minimal teratogenic impact of such exposures.

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